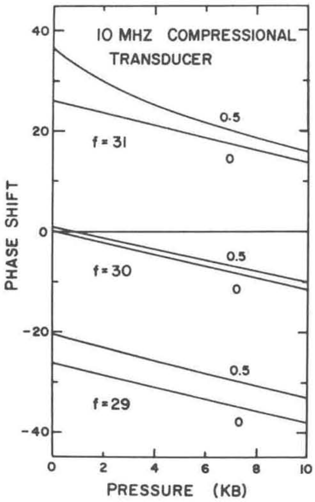

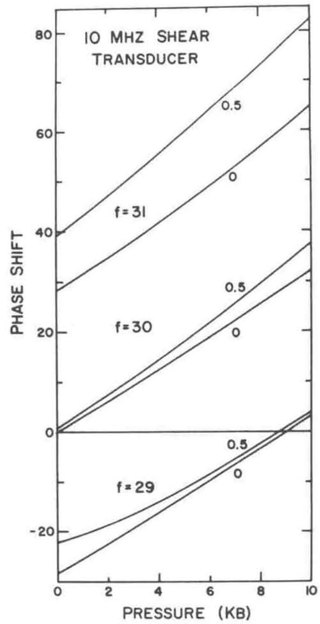

Fig. 6. (Left) Estimated effect of pressure on transducer-bond phase shifts for compressional [100] waves in MgF_2 with a 10-Mhz quartz transducer. Curves are for τ_f = 0 and 0.5 nsec and carrier frequency f = 29, 30, and 31 Mhz. Bond properties are estimated (Table 3). Fig. 7. (Right) As in Figure 6 for shear waves.

shifts. In Figure 6, at $f = 31$ Mhz, the bond phase shift decreases rapidly with increasing pressure, both because of the decreasing effective thickness of the bond and because f_r increases toward f. On the other hand, at $f = 29$ Mhz, f_r increases away from f, and the effects roughly cancel, so that the bond phase shift is fairly constant. These situations are reversed in Figure 7 because f_r decreases with increasing pressure for shear waves.

The reality of these effects was tested by comparison with some measurements on MgF_2 [100] compressional waves. Measurements of phase versus f at pressures up to 7 kbar were converted to phase versus pressure at frequencies f = 30, 31, and 32 Mhz. The results are shown in Figure 8(a). A systematic difference in slopes at the different frequencies, amounting to about 5%, can be discerned. Residuals relative to a line through the 30 Mhz data

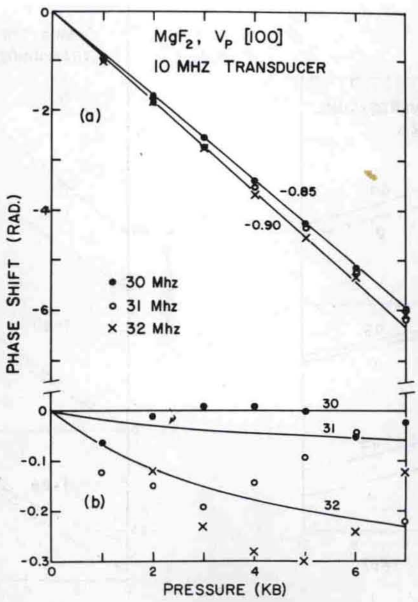

Fig. 8. (a) Measured phase shifts versus pressure (normalized to 30 Mhz) at 30, 31, and 32 Mhz for compressional [100] waves in MgF_2. Lines are labelled with slopes (rad/kbar). (b) Residuals of measured phase shifts relative to line through 30 Mhz data, compared with calculated transducer bond phase shifts, assuming bond properties (Table 3) and $\tau_f = 0.2$ nsec.

(shown in Figure 8(b)) are compared to calculated transducer-bond phase shifts, assuming $\tau_f = 0.2$ nsec (see previous section). Although there is considerable scatter in the residuals, their ordering and magnitudes are quite comparable to the calculated phase shifts, which is evidence that the phase shifts are being correctly described and that there are no other important effects on the measurements.

If the carrier frequency is accurately fixed at the transducer resonance frequency, the effect of the bond phase shift should be quite small. For instance, in Figure 7 the effect of the bond at 30 Mhz is about 15% of the effect of the transducer on the slope. Since the latter changes the value of $\partial M/\partial P$ by about -0.05, the effect of the bond phase shift on $\partial M/\partial P$ would be less than -0.01. If f deviates from f_{ro}, then of course the bond effect can be considerably larger. For instance, in Figure 6, at 31 Mhz the bond effect is comparable to that of the transducer.

Measurements of second pressure derivatives of elastic moduli